

WHAT IS CLAIMED IS:

1. A method of reducing the amount of peroxides in middle distillate fuels blended with one or more oxygenates, the method comprising the steps of:

providing a middle distillate fuel blended with one or more oxygenates;
combining the fuel with a hydrocarbon additive, the hydrocarbon additive comprising a polar functional group and a tertiary hydrogen beta to the functional group;

wherein the amount of hydrocarbon additive combined with the fuel reduces the amount of peroxides in the fuel as compared with the same fuel without the hydrocarbon additive.

2. A method as described in claim 1, wherein the polar functional group of the hydrocarbon is selected from the group consisting of the characteristic moieties of the following: alcohols, alkyl esters, carboxylic acids, ketones, aldehydes, amines, amine esters, nitro-, and nitrite-compounds, nitrate esters, phenols, and mixtures of one or more of the foregoing.

3. A method as described in claim 1, wherein one or more oxygenates are selected from the group consisting of the following: ethers, dimethyl ether (DME), butyl ether, amyl ether, di-n-butyl ether; glyme polyethers, diethylene glycol methyl ether (DGME), triethylene glycol dimethyl ether (triglyme), diethylene glycol dimethyl ether (diglyme), 1,2-dimethoxyethane (glyme), Cetaner (a blend of 96% glyme and 4% dimethoxymethane), ethylene glycol mono-tert-butyl ether, ethylene glycol mono-n-butyl ether; carbonates, dimethyl carbonate and diethyl carbonate; di-acetates, ethylene glycol acetate; acetals, dimethoxymethane (DMM or methyl-al), 2-ethylhexylacetate; esters of plant and animal oils, methyl soyate, alcohols, ketones, aldehydes, carboxylic acids and esters thereof, and mixtures of one or more of the foregoing.

4. A method as described in claim 1, wherein the hydrocarbon additive is described by the formula $R_1 R_2 CH-CH_2 - X$, wherein X is the polar functional group, and R_1 and R_2 are different alkyl groups of carbon chain length of between two and thirty carbon atoms appended to the carbon molecule beta to the polar functional group.

5. A method as described in claim 1, wherein the middle distillate fuel is selected from the group consisting of diesel fuel, biodiesel fuel, burner fuel, kerosene, gas oil, jet fuel, and gas turbine engine fuel.

6. A method as described in claim 1, wherein the fuel has a sulfur content of about 20 ppm or less.

7. A method as described in claim 1, wherein the fuel has a sulfur content of about 10 ppm or less.

8. A method as described in claim 1, wherein the fuel further comprises one or more components selected from the group consisting of: corrosion inhibitors, antioxidants, anti-rust agents, detergents and dispersants, fuel lubricity additives, demulsifiers, dyes, inert diluents, cold flow improvers, conductivity agents, metal deactivators, stabilizers, antifoam additives, de-icers, biocides, odorants, drag reducers, combustion improvers, MMT, oxygenates and like materials.

9. A method as described in claim 1, wherein the hydrocarbon additive is combined with the fuel at a treat rate of 500 to 2500 parts by volume per million parts of fuel.

10. A fuel composition comprising:
a middle distillate fuel;
an oxygenate; and
a hydrocarbon additive, the hydrocarbon additive comprising a polar functional group and a tertiary hydrogen beta to the functional group.

11. A fuel composition as described in claim 10, wherein the polar functional group of the hydrocarbon is selected from the group consisting of the characteristic moieties of the following: alcohols, alkyl esters, carboxylic acids, ketones, aldehydes, amines, amine esters, nitro-, and nitrite-compounds, nitrate esters, phenols, and mixtures of one or more of the foregoing.

12. A composition as described in claim 10, wherein the one or more oxygenates are selected from the group consisting of the following: ethers, dimethyl ether (DME), butyl ether, amyl ether, di-n-butyl ether; glyme polyethers, diethylene glycol methyl ether (DGME), triethylene glycol dimethyl ether (triglyme), diethylene glycol dimethyl ether (diglyme), 1,2-dimethoxyethane (glyme), Cetaner (a blend of 96% glyme and 4% dimethoxymethane), ethylene glycol mono-tert-butyl ether, ethylene glycol mono-n-butyl ether; carbonates, dimethyl carbonate and diethyl carbonate; diacetates, ethylene glycol acetate; acetals, dimethoxymethane (DMM or methylal), 2-ethylhexylacetate; esters of plant and animal oils, methyl soyate, methanol, ethanol, isopropanol, butanol, alcohols, ketones, aldehydes, carboxylic acids and esters thereof, and mixtures of one or more of the foregoing.

13. A composition as described in claim 10, wherein the hydrocarbon additive is described by the formula $R_1 R_2 CH-CH_2 - X$, wherein X is the polar functional group, and R_1 and R_2 are different alkyl groups of carbon chain

length of between two and thirty carbon atoms appended to the carbon molecule beta to the polar functional group.

14. A composition as described in claim 10, wherein the middle distillate fuel is selected from the group consisting of diesel fuel, biodiesel fuel, burner fuel, kerosene, gas oil, jet fuel, and gas turbine engine fuel.

15. A composition as described in claim 10, wherein the fuel has a sulfur content of about 20 ppm or less.

16. A composition as described in claim 10, wherein the fuel has a sulfur content of about 10 ppm or less.

17. A composition as described in claim 10, wherein the fuel further comprises one or more components selected from the group consisting of: corrosion inhibitors, antioxidants, anti-rust agents, detergents and dispersants, fuel lubricity additives, demulsifiers, dyes, inert diluents, cold flow improvers, conductivity agents, metal deactivators, stabilizers, antifoam additives, de-icers, biocides, odorants, drag reducers, combustion improvers, MMT, oxygenates and like materials.

18. A composition as described in claim 10, wherein the amount of hydrocarbon additive is 500 to 2500 parts by volume per million parts of fuel.

19. A hydrocarbon additive for a middle distillate fuel containing an oxygenate, the additive comprising a polar functional group and a tertiary hydrogen beta to the functional group.

20. A hydrocarbon additive as described in claim 19, wherein the polar functional group of the hydrocarbon is selected from the group consisting of the characteristic moieties of the following: alcohols, alkyl esters, carboxylic

acids, ketones, aldehydes, amines, amine esters, nitro-, and nitrite-compounds, nitrate esters, phenols, and mixtures of one or more of the foregoing.

21. A hydrocarbon additive as described in claim 19, wherein the hydrocarbon additive is described by the formula $R_1 R_2 CH-CH_2 - X$, wherein X is the polar functional group, and R_1 and R_2 are different alkyl groups of carbon chain length of between two and thirty carbon atoms appended to the carbon molecule beta to the polar functional group.

22. A hydrocarbon additive as described in claim 19, wherein the additive is adapted to be combined with the fuel at a treat rate of 500 to 2500 parts by volume per million parts of fuel.

23. A method of enhancing the durability of middle distillate fuel system elastomers comprising the steps of:
providing a middle distillate fuel blended with one or more oxygenates;
combining the fuel with a hydrocarbon additive, the hydrocarbon additive comprising a polar functional group and a tertiary hydrogen beta to the functional group;

wherein the amount of hydrocarbon additive combined with the fuel enhances the durability of middle distillate fuel systems elastomers as compared with the durability of elastomers in a middle distillate fuel system combusting a middle distillate fuel without the hydrocarbon additive.

24. A method as described in claim 23, wherein the polar functional group of the hydrocarbon is selected from the group consisting of the characteristic moieties of the following: alcohols, alkyl esters, carboxylic acids, ketones, aldehydes, amines, amine esters, nitro-, and nitrite-compounds, nitrate esters, phenols, and mixtures of one or more of the foregoing.

25. A method as described in claim 23, wherein the one or more oxygenates are selected from the group consisting of the following: ethers, dimethyl ether (DME), butyl ether, amyl ether, di-n-butyl ether; glyme polyethers, diethylene glycol methyl ether (DGME), triethylene glycol dimethyl ether (triglyme), diethylene glycol dimethyl ether (diglyme), 1,2-dimethoxyethane (glyme), Cetaner (a blend of 96% glyme and 4% dimethoxymethane), ethylene glycol mono-tert-butyl ether, ethylene glycol mono-n-butyl ether; carbonates, dimethyl carbonate and diethyl carbonate; diacetates, ethylene glycol acetate; acetals, dimethoxymethane (DMM or methylal), 2-ethylhexylacetate; esters of plant and animal oils, methyl soyate, methanol, ethanol, isopropanol, butanol, alcohols, ketones, aldehydes, carboxylic acids and esters thereof, and mixtures of one or more of the foregoing.

26. A method as described in claim 23, wherein the hydrocarbon additive is described by the formula $R_1 R_2 CH-CH_2 - X$, wherein X is the polar functional group, and R_1 and R_2 are different alkyl groups of carbon chain length of between two and thirty carbon atoms appended to the carbon molecule beta to the polar functional group.

27. A method as described in claim 23, wherein the middle distillate fuel is selected from the group consisting of diesel fuel, biodiesel fuel, burner fuel, kerosene, gas oil, jet fuel, and gas turbine engine fuel.

28. A method as described in claim 23, wherein the fuel has a sulfur content of about 20 ppm or less.

29. A method as described in claim 23, wherein the fuel has a sulfur content of about 10 ppm or less.

30. A method as described in claim 23, wherein the fuel further comprises one or more components selected from the group consisting of: corrosion inhibitors, antioxidants, anti-rust agents, detergents and dispersants, fuel lubricity additives, demulsifiers, dyes, inert diluents, cold flow improvers, conductivity agents, metal deactivators, stabilizers, antifoam additives, de-icers, biocides, odorants, drag reducers, combustion improvers, MMT, oxygenates and like materials.

31. A method as described in claim 23, wherein the hydrocarbon additive is combined with the fuel at a treat rate of 500 to 2500 parts by volume per million parts of fuel.

32. A method of enhancing color durability of a middle distillate fuel blended with one or more oxygenates comprising the steps of:

providing a middle distillate fuel blended with one or more oxygenates;
combining the fuel with a hydrocarbon additive, the hydrocarbon additive comprising a polar functional group and a tertiary hydrogen beta to the functional group;

wherein the amount of hydrocarbon additive combined with the fuel enhances the color durability of the middle distillate fuels as compared with the color durability of a middle distillate fuel blended with one or more oxygenates without the hydrocarbon additive.

33. A method as described in claim 32, wherein the polar functional group of the hydrocarbon is selected from the group consisting of the characteristic moieties of the following: alcohols, alkyl esters, carboxylic acids, ketones, aldehydes, amines, amine esters, nitro-, and nitrite-compounds, nitrate esters, phenols, and mixtures of one or more of the foregoing.

34. A method as described in claim 32, wherein the one or more oxygenates are selected from the group consisting of the following: ethers, dimethyl ether (DME), butyl ether, amyl ether, di-n-butyl ether; glyme polyethers, diethylene glycol methyl ether (DGME), triethylene glycol dimethyl ether (triglyme), diethylene glycol dimethyl ether (diglyme), 1,2-dimethoxyethane (glyme), Cetaner (a blend of 96% glyme and 4% dimethoxymethane), ethylene glycol mono-tert-butyl ether, ethylene glycol mono-n-butyl ether; carbonates, dimethyl carbonate and diethyl carbonate; diacetates such as ethylene glycol acetate; acetals, dimethoxymethane (DMM or methylal), 2-ethylhexylacetate; esters of plant and animal oils, methyl soyate, methanol, ethanol, isopropanol, butanol, alcohols, ketones, aldehydes, carboxylic acids and esters thereof, and mixtures of one or more of the foregoing.

35. A method as described in claim 32, wherein the hydrocarbon additive is described by the formula $R_1 R_2 CH-CH_2 - X$, wherein X is the polar functional group, and R_1 and R_2 are different alkyl groups of carbon chain length of between two and thirty carbon atoms appended to the carbon molecule beta to the polar functional group.

36. A method as described in claim 32, wherein the middle distillate fuel is selected from the group consisting of diesel fuel, biodiesel fuel, burner fuel, kerosene, gas oil, jet fuel, and gas turbine engine fuel.

37. A method as described in claim 32, wherein the fuel has a sulfur content of about 20 ppm or less.

38. A method as described in claim 32, wherein the fuel has a sulfur content of about 10 ppm or less.

39. A method as described in claim 32, wherein the fuel further comprises one or more components selected from the group consisting of: corrosion inhibitors, antioxidants, anti-rust agents, detergents and dispersants, fuel lubricity additives, demulsifiers, dyes, inert diluents, cold flow improvers, conductivity agents, metal deactivators, stabilizers, antifoam additives, de-icers, biocides, odorants, drag reducers, combustion improvers, MMT, oxygenates and like materials.

40. A method as described in claim 32, wherein the hydrocarbon additive is combined with the fuel at a treat rate of 500 to 2500 parts by volume per million parts of fuel.

41. A method of enhancing the fuel stability of a middle distillate fuel blended with one or more oxygenates comprising the steps of:

providing a middle distillate fuel blended with one or more oxygenates;
combining the fuel with a hydrocarbon additive, the hydrocarbon additive comprising a polar functional group and a tertiary hydrogen beta to the functional group;

wherein the amount of hydrocarbon additive combined with the fuel enhances the fuel stability of the middle distillate fuel as compared with the fuel stability of a middle distillate fuel blended with one or more oxygenates without the hydrocarbon additive.

42. A method as described in claim 41, wherein the polar functional group of the hydrocarbon is selected from the group consisting of the characteristic moieties of the following: alcohols, alkyl esters, carboxylic acids, ketones, aldehydes, amines, amine esters, nitro-, and nitrite-compounds, nitrate esters, phenols, and mixtures of one or more of the foregoing.

43. A method as described in claim 41, wherein the one or more oxygenates are selected from the group consisting of the following: ethers, dimethyl ether (DME), butyl ether, amyl ether, di-n-butyl ether; glyme polyethers, diethylene glycol methyl ether (DGME), triethylene glycol dimethyl ether (triglyme), diethylene glycol dimethyl ether (diglyme), 1,2-dimethoxyethane (glyme), Cetaner (a blend of 96% glyme and 4% dimethoxymethane), ethylene glycol mono-tert-butyl ether, ethylene glycol mono-n-butyl ether; carbonates, dimethyl carbonate and diethyl carbonate; diacetates, ethylene glycol acetate; acetals, dimethoxymethane (DMM or methylal), 2-ethylhexylacetate; esters of plant and animal oils, methyl soyate, methanol, ethanol, isopropanol, butanol, alcohols, ketones, aldehydes, carboxylic acids and esters thereof, and mixtures of one or more of the foregoing.

44. A method as described in claim 41, wherein the hydrocarbon additive is described by the formula $R_1 R_2 CH-CH_2 - X$, wherein X is the polar functional group, and R_1 and R_2 are different alkyl groups of carbon chain length of between two and thirty carbon atoms appended to the carbon molecule beta to the polar functional group.

45. A method as described in claim 41, wherein the middle distillate fuel is selected from the group consisting of diesel fuel, biodiesel fuel, burner fuel, kerosene, gas oil, jet fuel, and gas turbine engine fuel.

46. A method as described in claim 41, wherein the fuel has a sulfur content of about 20 ppm or less.

47. A method as described in claim 41, wherein the fuel has a sulfur content of about 10 ppm or less.

48. A method as described in claim 41, wherein the fuel further comprises one or more components selected from the group consisting of: corrosion inhibitors, antioxidants, anti-rust agents, detergents and dispersants, fuel lubricity additives, demulsifiers, dyes, inert diluents, cold flow improvers, conductivity agents, metal deactivators, stabilizers, antifoam additives, de-icers, biocides, odorants, drag reducers, combustion improvers, MMT, oxygenates and like materials.

49. A method as described in claim 41, wherein the hydrocarbon additive is combined with the fuel at a treat rate of 500 to 2500 parts by volume per million parts of fuel.

50. A method of reducing fuel sediment in a middle distillate fuel blended with one or more oxygenates comprising the steps of:
providing a middle distillate fuel blended with one or more oxygenates;
combining the fuel with a hydrocarbon additive, the hydrocarbon additive comprising a polar functional group and a tertiary hydrogen beta to the functional group;
wherein the amount of hydrocarbon additive combined with the fuel reduces fuel sediment in the middle distillate fuel as compared with the fuel sediment in the middle distillate fuel blended with one or more oxygenates without the hydrocarbon additive.

51. A method as described in claim 50, wherein the polar functional group of the hydrocarbon is selected from the group consisting of the characteristic moieties of the following: alcohols, alkyl esters, carboxylic acids, ketones, aldehydes, amines, amine esters, nitro-, and nitrite-compounds, nitrate esters, phenols, and mixtures of one or more of the foregoing.

52. A method as described in claim 50, wherein the one or more oxygenates are selected from the group consisting of the following: ethers,

dimethyl ether (DME), butyl ether, amyl ether, di-n-butyl ether; glyme polyethers, diethylene glycol methyl ether (DGME), triethylene glycol dimethyl ether (triglyme), diethylene glycol dimethyl ether (diglyme), 1,2-dimethoxyethane (glyme), Cetaner (a blend of 96% glyme and 4% dimethoxymethane), ethylene glycol mono-tert-butyl ether, ethylene glycol mono-n-butyl ether; carbonates, dimethyl carbonate and diethyl carbonate; diacetates, ethylene glycol acetate; acetals, dimethoxymethane (DMM or methylal), 2-ethylhexylacetate; esters of plant and animal oils, methyl soyate, methanol, ethanol, isopropanol, butanol, alcohols, ketones, aldehydes, carboxylic acids and esters thereof, and mixtures of one or more of the foregoing.

53. A method as described in claim 50, wherein the hydrocarbon additive is described by the formula $R_1 R_2 CH-CH_2 - X$, wherein X is the polar functional group, and R_1 and R_2 are different alkyl groups of carbon chain length of between two and thirty carbon atoms appended to the carbon molecule beta to the polar functional group.

54. A method as described in claim 50, wherein the middle distillate fuel is selected from the group consisting of diesel fuel, biodiesel fuel, burner fuel, kerosene, gas oil, jet fuel, and gas turbine engine fuel.

55. A method as described in claim 50, wherein the fuel has a sulfur content of about 20 ppm or less.

56. A method as described in claim 50, wherein the fuel has a sulfur content of about 10 ppm or less.

57. A method as described in claim 50, wherein the fuel further comprises one or more components selected from the group consisting of: corrosion inhibitors, antioxidants, anti-rust agents, detergents and

dispersants, fuel lubricity additives, demulsifiers, dyes, inert diluents, cold flow improvers, conductivity agents, metal deactivators, stabilizers, antifoam additives, de-icers, biocides, odorants, drag reducers, combustion improvers, MMT, oxygenates and like materials.

58. A method as described in claim 50, wherein the hydrocarbon additive is combined with the fuel at a treat rate of 500 to 2500 parts by volume per million parts of fuel.